Shropshire Botanical Society Newsletter, Spring 2015

Clockwise from top left *Viola riviniana*, Common Dog-violet (photo D. Wrench), *V. reichenbachiana*, Early Dog-violet (photo I. Trueman), *V. odoratum* var *dumetorum* Sweet Violet (photo J. Handley)

Colony of *Polypodium interjectum* growing in Tankerville, Stiperstones (photo M. Duffell)

P. interjectum showing weakly ovate profile of frond and strongly inflexed lowest pair of pinnae (photo M. Duffell)

Underside of frond of *Polypodium cambricum*, showing orange sori on either side of pinnae (photo M. Duffell)

Shropshire Botanical Society Newsletter No.30

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Past copies of the newsletter are available as pdfs from the Shropshire Botanical Society website: http://www.bsbi.org.uk/shropshire.html

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Our thanks to the Shropshire Wildlife Trust and the Field Studies Council for their generous support of our society. Both organisations support the work of the society in recognition of the importance of the contribution we make to understanding Shropshire botany.

Society Matters Mags Cousins

The big news is we will be launching the new and updated *Flora and Vegetation of Shropshire* on the same date and at the same place as the Spring Meeting and AGM. So come along to the launch party, where you will be able to collect your copy and then go straight on to a great talk at our first meeting of the year, plus a tiny bit of Bot Soc business! We just have a few elections for the committee to do. If anyone is interested in getting more involved, nominations for new committee members are welcome. Please contact Penny if you want to be more involved in running your society; Secretary Penny Wysome, email: pennywysome@yahoo.com.

If you haven't yet ordered your copy of the Flora but intend coming to the launch or spring meeting and would like to make sure that you can collect your copy on that day and **not** incur the £4.40 postage charge, please send your order at £35 per book to the Treasurer Sue Townsend email: sue.t@field-studies-council.org, Tel. 07977 574980. Prior purchase will also help the team plan the number of copies to bring on the day.

Book Launch: *Flora and Vegetation of Shropshire*, Saturday 28th March 2015, at 12–1.30 pm in the Queen Anne Room, Preston Montford Field Studies Centre, Montford Bridge, Shrewsbury, SY4 1DX.

There will be light refreshments and fizz to launch the release of the new and updated *Flora and Vegetation of Shropshire* by Alex Lockton and Sarah Whild. Come and celebrate their achievement. All welcome but booking is essential, please R.S.V.P. to Sue Townsend, email: sue.t@field-studies-council.org or Tel. 01743 852040.

Followed by the: Spring Meeting and AGM, 2–4 pm in the Darwin Room, Preston Montford Field Studies Centre, as above.

Dr Jonathan Mitchley will be giving us his unique take on botany with a talk entitled:

"eXtreme botany: what's it all about?"

Dr Jonathan Mitchley is Associate Professor of Botany at the University of Reading, and author of the inspirational 'DrMGoesWild.com'.

Other Dates for your diary

Shropshire Botanical Society Winter Meeting Saturday 12th December 2015, 2–4 pm

Christmas social and speaker Dr Jonathan Briggs, at our usual venue, Preston Montford Field Studies Centre, Montford Bridge, Shrewsbury, SY4 1DX.

Field Meetings 2015

Everyone is welcome to the outings, an appreciation of plants and sensible outdoor gear and packed lunch and drink is all that is required. Please contact the leader beforehand to check arrangements and make sure that the day will be going ahead as planned. Some visits require pre-booking, as numbers may be limited on sensitive habitats.

Sunday 17th May 11:00 am Hobarris Wood. Woodland and meadow plants including *Geranium sylvaticum*, Wood Geranium and *Cardamine impatiens*, Narrow-leaved Bitter-cress. There are also old records for *Serratula tinctoria*, Saw-wort. Meet at Chapel Lawn Village Hall, Grid Ref SO315763, then car-share to get closer to the site.
Contact John Clayfield, Tel. 01547 530298.

Saturday 4th July 11:00 am Benthall Edge Wood and Quarry. A search through the wood, quarry and old railway for horsetails and ferns, especially *Dryopteris*, Buckler-fern species. We will keep a good look out for *D.* × *complexa* (*Dryopteris filix-mas* × *affinis*) Fraser-Jenk, which should be about. Meet in the car park on the far side of the Iron Bridge at Grid Ref SJ671033.
Contact Martin Godfrey, email: martinandrosie@aol.com or Tel. 01785 229713.

Saturday 25th July 10:30 am Withybed Wood, Wyre Forest. We will have a look at some very heathy woodland rides, a stream dingle and some wet, base-rich, flushes on the National Nature Reserve. Meet at the Forestry Commission Hawkbatch Car Park, off Button Oak B4194 road (1 km south-east of Button Oak) at Grid Ref SO761776. Bring sturdy footwear as there are a few steep valley sides to climb, but nothing too strenuous.
Contact John Bingham, email: jb8dcb@btinternet.com.

Sunday 2nd August 10:00 am – 4 pm The Stiperstones. *Juncaceae* Training Day - beginners welcome. A meeting to gain an understanding of Rushes and their allies, with leaders Mark Duffell and Sarah Whild. Learn the characters that define this group and how to start separating them using keys. Expected distance is not great, but going may be rough and very wet in places so wellies or waterproof walking boots are essential. Meet at the Knolls Car park Grid Ref SO369976, known locally as Cranberry Rock Car park. Nearest postcode is SY5 0NG (The Bog Visitors Centre).
Contact Mark Duffell, email: enquiries@ArvensisEcology.co.uk, Tel. 01743 851084, or Mob. 07821 031359. Pre-booking required.

Sunday 16th August 11.00 am Devil's Dingle Ash Disposal Site, Buildwas. A look at the plant communities developing on Ironbridge Power Station disused ash disposal site. Likely to be some interesting botanical finds to accompany an already impressive list of invertebrates. Some slopes and moderately rough ground. Meet at the main gate to the site at Grid Ref SJ64240458, this is the driveway on the north side of the B4380, on the east side of Buildwas village.
Contact Mary Thornton, email: mary.thornton@eon-uk.com or Mob. 07971 933018.

Sunday 6th Sept 10.30 am Long Mynd flushes. A recording visit for the National Trust, to previously *Juncus effusus* Soft Rush dominated flushes near Wild Moor Pool which have been strimmed and raked to improve conditions for breeding Snipe. Has the botany also benefitted? Meet at Wild Moor Pool car park, Grid Ref SO 42509659.
Contact Mags Cousins, email: mags@bagbatch.co.uk or Mob. 07791 505641.

Courses

Field Studies Council: Preston Montford Day Courses, 2015, Preston Montford Field Studies Centre, Montford Bridge, Shrewsbury, SY4 1DX.

Enclosed with your newsletter is a leaflet with a list of courses that might interest you, run by the FSC and based at our local Preston Montford centre. It is a great opportunity to brush up your skills with excellent tutors over a wide range of genera. If you want to venture further afield or delve into other groups the FSC website: http://www.field-studies-council.org/ has a wide range of courses on offer across the country.

Sphagnum Microscopy Workshop 14th November 2015,

Preston Montford Field Studies Centre, as above.

This is a Lab-based workshop to cover the microscopy techniques in Martin Godfrey's Sphagnum article in this edition of the newsletter. It is organised in conjunction with the new FSC project "Tomorrows Biodiversity" and the British Bryological Society. For details and bookings please follow this link:

http://www.field-studies-council.org/individuals-and-families/courses/2015/pm/sphagnum-microscopy-workshop-50045.aspx

Manchester Metropolitan University, Biological Recording Day Courses 2015, at The Gateway Education and Art Centre, Chester Street, Shrewsbury, SY1 1NB.

We are lucky to have another excellent and local training programme for anyone interested in Botany through the MMU Courses in Biological Recording. Here is a selection for this year:

Tackling Plant Identification	8th April	Mark Duffell
Identifying Grasses in Spring	20th May	Sarah Whild
Identifying Umbellifers	24th June	Mark Duffell
Docks and Knotweeds	5th August	Ros Bennett
Daisies, Dandelions and Thistles	2nd September	Mark Duffell
Lamiaceae and Scrophulariaceae	9th September	Mark Duffell

All Courses start at 10 am – 4 pm, and the cost is £45.

Visit the website: http://www.sste.mmu.ac.uk/recording for the full range of courses on offer. You can book by downloading the leaflet for each course from here or for further information other contact details are below:

Email: biorec@mmu.ac.uk
Tel. 01743 355137
Facebook: MMU Biological Recording
Twitter: @MMUBioRecs

Plant Records

Alex Lockton & Sarah Whild

So far we have input some 10,000 records for 2014, with maybe another 5,000 that have been sent in but not yet checked and incorporated. Our thanks to everyone who has contributed. A huge amount of recording has taken place by Shropshire Wildlife Trust, who sent us a large data file, including many good surveys by Botanical Society members. A great advantage of this is that the Trust often gains access to private land that Bot Soc members would not visit, and this certainly helps with under-recorded areas. Inevitably the process of transcribing the data eg from paper to spreadsheet, especially when done by someone other than the original surveyor, can lead to errors, for example the wrong species name. Where these mistakes are obvious the data will not be included as records by the County Recorder. So if anyone has any interesting finds that they would like to share, please also send your raw data direct to the County Recorder; otherwise it could well be lost.

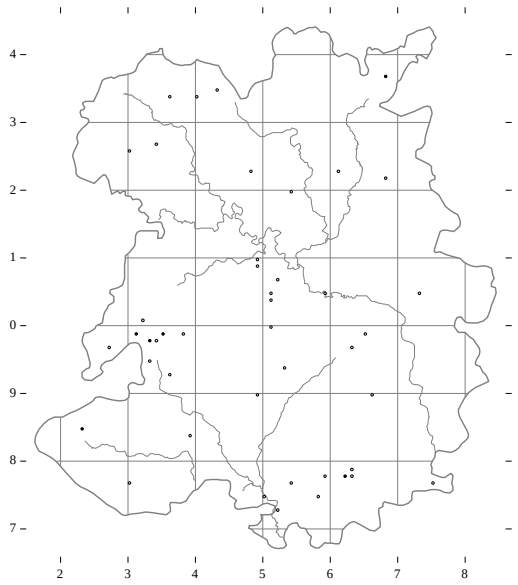
Only records checked by the County Recorder get incorporated into the national atlases and databases, and this is so in all counties.

Records received so far in 2014

Baxendale, Mr M.	36	Gulliver, Dr R.L.	1	Spencer, Mr S.	47
Bell, Mr K.K.	2	Handley, Mr J.	1227	Stone, Ms N.	1
Callaghan, Dr D.A.	769	Harris, Mr R.C.	1	Sudd, Mr J.	1
Clayfield, Mr J.	1334	Heaton, Mr S.	2	Swindells, Mrs S.	2
Cousins, Mrs M.	420	Heideman, Mr A.	1948	Thorne, Dr A.K.	570
Critchley, Ms H.	60	Higson, Mrs P.	247	Trueman, Prof I.C.	315
Davies, Mr S.	16	Hill, Mr D.	179	Walker, Mr C.	959
Dawes, Mr A.P.	1	Ing, Mrs J.	94	Wall, Mr T.	1
Dawes, Mrs R.A.	149	Jukes-Hughes, Mr R.	4	Wallace, Dr H.	8
Diack, Mr I.	288	Lockton, Mr A.J.	364	Whild, Dr S.J.	200
Duffell, Mr M.S.	45	Mackirdy, Ms K.	1510	Wilson, Ms F.	181
Evans, Mr P.	7	Moss, Mr G.	1	Wilson, Ms G.	175
Fussell, Mr R.	12	O'Donnell, Dr S.	287	Winnall, Ms R.	1
Gardener, Ms S.	128	Rowe, Mr R.	717	Wrench, Mr D.H.	900
Gillard, Ms R.	812	Sams, Ms P.	1	Wysome, Mrs P.J.	2
Gomersall, Mrs F.J.	1028	Singleton, Mrs K.	312		

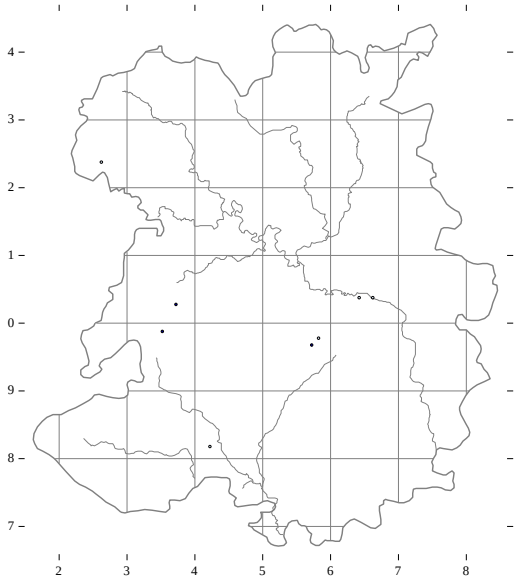
Rob Rowe reported the finding of *Cystopteris fragilis* (L.) Bernh., Brittle Bladder-fern, on two bridges at Cwnd, SO3895. This gives the precise locality and confirmation of a 1993 tetrad record, and brings the number of current sites to nine.

Rob also found *Genista anglica* L., Petty Whin, on Stapeley Hill (SO315981), where it has previously been recorded by Norah Mackenzie in 1953 and Charles Sinker in 1958. There are now just six sites for it in the county.



Genista anglica

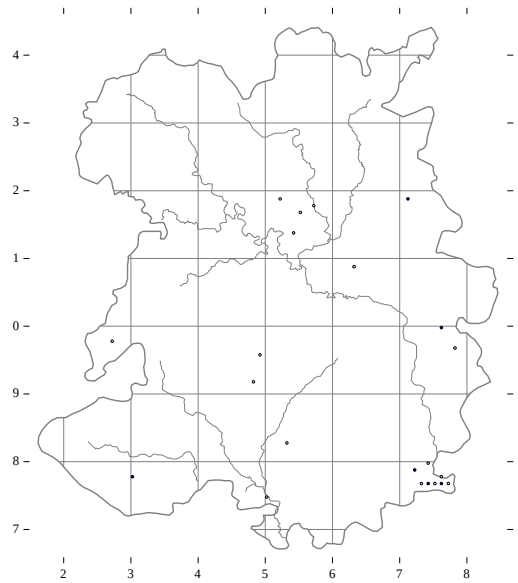
Rob Rowe found a new site for *Hypopitys monotropa* Crantz, **Yellow Bird's-nest**, at Snailbeach, SJ373022. This adds a new hectad dot to the national map and brings the number of extant sites in the county to three.



Hypopitys monotropa

Roy Fussell found a nice patch of **Saw-wort**, *Serratula tinctoria* L., on a roadside near Edgmond (SJ711186) on 27th July 2014. This brings the number of known sites to 6, although it is not abundant in any of them. In 2013 it was rediscovered at Badger Dingle (SO7699) during the Botanical Society visit; it had last been recorded there in 1914 by H.E. Forrest. Other current sites are Hobarris Wood (SO3077, John Clayfield, 2012); Chamberline Wood (SO7676); Hall of Hammonds (SO7278) and Wimperhill Wood (SO7476) (all by John Bingham, 2004).

Saw-wort, *Serratula tinctoria* (Roy Fussell)



Serratula tinctoria

Places to look out for it include the Hollies, Ticklerton (SO488914), where it was last recorded by Dan Wrench in 1994, and Marrington Dingle, where it was also last seen by H.E. Forrest in 1914.

Polypodium in Shropshire

Mark Duffell

The Genus *Polypodium* is one of the more recognisable genera within British Ferns, with its rhizomatous growth form and "once pinnate" fronds[1]. Within the British Isles there are currently three species: *Polypodium vulgare* L. Common Polypody; *P. interjectum* Shivas Intermediate or Western Polypody and *P. cambricum* L. Southern Polypody, plus three hybrids. In Shropshire we get all three species plus one of the hybrids.

Identification to genus is easy but diagnosing any further requires the use of a low power microscope to view certain characters; with time and experience these characters can be seen with a × 20 hand lens. Whilst the frond outline gives a strong clue as to the identity, without sporangia being present only a best guess at identification can be made and identification should be restricted to *Polypodium vulgare* s.l.[2] with a return visit made to collect fertile material later in the year.

The characters used to determine the species can be split into macro and micro characters. Macro characters include the overall outline of the frond and the relative length of the longest pinnae to the other pinnae. Micro characters relate to the sori, their overall shape, presence or absence of paraphyses within the sori, number of basal cells and number of indurated or annulus cells within the sporangium. The colour of the annulus is another useful character.

When growing well and not showing any introgression with other species, the frond outlines are relatively distinct. *P. vulgare* has a linear, almost parallel sided look, with the bottom pinnae being about the same length as the majority of the pinnae. In *P. interjectum*, the longest pinnae is the second from the base giving a shallowly ovate to oval appearance; whilst in *P. cambricum* it is the 4th to 6th pinnae from the base which are the longest, which gives it a strongly ovate shape. In *P. interjectum* and *P. cambricum* the lowest 'pair' of pinnae are inflexed (being bent or curved inwards giving a 3D look to the lower frond; this character is partially lost in pressed specimens).

Other macro characters used in some texts include the degree of toothing along the pinnae with *P. cambricum* being serrated, *P. interjectum* slightly serrated and *P. vulgare* entire; and the shape of rhizome scales.

Several authors mention rhizome scales as useful additional characters (Jermy and Camus 1991), with those of *P. vulgare* being described as narrowly triangular with acute, but not long and wispy apex, *P. interjectum* narrowly triangular with long, but not wispy apex and *P. cambricum* with narrowly triangular with a long wispy apex. In Flora Europaea (Valentine and Moore 1993), the length of rhizome scales are used to separate *P. cambricum* (some > 10 mm long) and *P. macaronesicum* (from Spain and Canary Island) from *P. vulgare/P.interjectum* (< 10 mm long).

Excluding the Flora Europaea which specifies a measurement, the use of toothing and rhizome scale characters are subjective and only seem to work well on 'good' material.

[1] Strictly the fronds are pinnatisect (deeply pinnately lobed almost to the rachis), although most identification books excluding the Vegetative Flora (Poland 2009) consider them once-pinnate.

[2] s.l. = sensu lato – literally meaning in the broadest sense.

For accurate identification you need to rely on looking at the micro characters. Firstly the shape of the sori (group of sporangia), is it more or less round (*P. vulgare*) or oval (*P. interjectum/P. cambricum*); even in quite immature sori the shape can be determined. The colour of the sori is also useful, *P. vulgare* having a rich golden egg yolk colour, compared to paler yellow in the other two species. The position of the sori on the frond is slightly different in each species: *P. cambricum* restricted to upper ⅓ of the frond, *P. interjectum* ⅓-⅔ of the frond, and in *P. vulgare* the upper ¼-¾ of the frond. These characters are easily observed with the naked eye or hand lens.

Annulus or indurated cells are a line of cells found on the back of the sporangium, the thickening (or induration) of the walls helps the sporangium to burst when mature. At the base of the annulus cells are one to four cells without thickened walls called basal cells (Figure 1 and Figure 2).
The relative number of annulus cells and basal cells present within the sporangium are extremely useful in separating the species. The mean number of annulus cells and number of basal cells are shown in Table 1. Alongside this the colour of the annulus walls is distinct with *P. vulgare* being reddish-brown, *P. interjectum* pale brown and *P. cambricum* dark brown. The dimensions of the indurated cells are useful for separating species and hybrids and are given in Hutchinson and Thomas (1996). In *P. vulgare* you can usually see the indurated cells with a hand lens as a thin dark brown line on the sporangium.

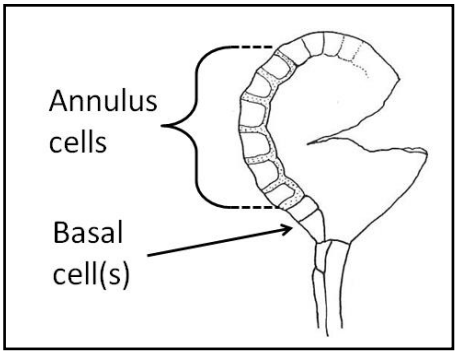


Figure 1: Sporangium viewed from side showing annulus and basal cells. Image: © Jermy and Camus 1991

In *P. cambricum* (and *P. × shivasiae*) within the sorus, among the sporangia, are translucent 3-4 celled hair like structures called Paraphyses which are often branched; measuring between 0.5-1.4 mm. With care these can be seen with a × 20 lens.
The presence of hybrid material can be confirmed by looking at the sporangia, many of which will abort before maturing and remain small and unopened. If spores are present then they are colourless or white rather than yellow in fertile material; although a few apparently fertile spores may be found.

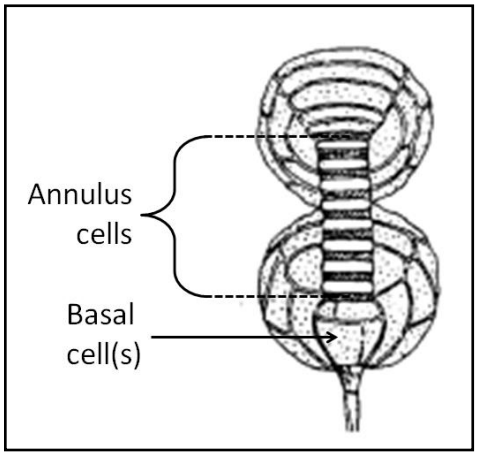


Figure 2: Sporangium viewed from back showing annulus and basal cells. Image: © Rich and Jermy 1998.

There are three hybrids recorded from the British Isles: *P. × font-queri* Rothm. (*P. cambricum* × *P. vulgare*), *P. × mantoniae* Rothm. (*P. interjectum* × *P. vulgare*) and *P. × shivasiae* Rothm. (*P. cambricum* × *P. interjectum*).

Within Shropshire only *P. × mantoniae* has been recorded, the other hybrids being well outside the area. This hybrid is intermediate between the parents, with similar numbers of annulus cells. It can be recognised by its vigour, and then confirmed by the lack of fertile material. Hutchinson and Thomas (1996) should be checked when determining hybrid material.

Phenology is another useful identification feature, in *P. vulgare* the new fronds are produced in early summer with spores ripening in July-August, with *P. interjectum* late summer and sporing in July to December, followed by *P. cambricum* which sends new fronds up in autumn to winter (spores only ripening in late autumn through to early spring).

	Annulus cells[3]	Basal cells
	No of annulus cells	**No of basal cells**
P. vulgare	(7-) **10-14** (-17)	**1**
P. interjectum	(4-) **7-9** (-13)	**2-3**
P. cambricum	(2-) **5-10** (-18)	**3-4**
P. × mantoniae	(2-) **9-11** (-14)	(1-) **1.5-2.0** (-3)

Table 1: Number of Annulus and Basal cells in *Polypodium* (from Rich and Jermy 1998; Roberts 1998; Hutchinson and Thomas 1996)

Each species has a distinct ecology with *P. vulgare* favouring acid rocks and soils, being equally at home on peaty soils, trees, dry stone walls and rocky outcrops. *P. interjectum* grows on weakly acid to basic rocks and soils, often found growing on the joints mortared walls, as well as high up on trees especially in more humid areas. *P. cambricum* is a strong calcicole again growing on walls but often on cliffs and steeper sites.

In Shropshire *P. cambricum* is the least common, restricted to 5 sites, of which only three have recent records. A good site to see this species is Blodwel Rock in northwest Shropshire; a historical record exists on the walls Ludlow Castle but it has not been recorded there for many years. Both *P. interjectum* and *P. vulgare* are can be found throughout the county. The hybrid *P. × mantoniae* has only been recorded twice within Shropshire, at Grinshill and Llynclys Hill both in the late 1990s; it is undoubtedly under-recorded both here and throughout the British Isles.

The etymology of the scientific names for Western Polypody of *interjectum* meaning 'cast between' hints at its hybrid origins arising from a historical cross between *P. cambricum* and *P. vulgare* that has now stabilised and many of its characters are intermediate between the two parents. The species was only described in 1961 by Shivas (Shivas 1961) who using genetics proved that it was derived from the tetraploid *P. vulgare* and diploid *P. cambricum* to create the hexaploid *P. interjectum. P. interjectum* is fertile and back crosses with both parents to produce *P. × mantoniae* and *P. × shivasiae*.

An excellent resource for the identification of Polypodies is Ferns, Clubmosses, Quillworts and Horsetails of Cornwall and the Isles of Scilly by Murphy, R.J., Page, C.N., Parslow, R.E. and Bennallick, I.J. Featuring good photographs of living and herbarium material for the species and hybrids along with identification tips and ecological notes. Photographs of many of the structures discussed here including close-ups of sporangia and paraphyses feature on Roger Golding's website *http://www.ferns.rogergolding.co.uk/ferngenus/polypodium.html*

Recording these ferns need not be difficult, as long as you collect a small amount of (fertile) material with a rhizome scales attached along with full biological record. These can be pressed and identified at a later date (although some of the features can be harder to see on pressed material). Both Martin Godfrey and I (addresses below) would be happy to look at material for confirmation/determination.

[3] Range in brackets with mean e.g. *P. vulgare* range is 7-17 annulus cells but mean 10-14.

Hopefully this paper will stimulate further recording of this rewarding if occasionally challenging group, and *Polypodium* × *mantoniae* will also be found at more sites as it is certainly under-recorded in Shropshire and surrounding counties.

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Acknowledgement: With thanks to Martin Godfrey for allowing me to reproduce his key to the three species and for commenting on this paper.

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Shropshire Violets

Ruth Dawes

Our county violets are all perennial herbs, often with basal leaves only. The violet family have solitary, bisexual, zygomorphic flowers with five petals, the lower one with a backwards-pointing spur. Violets have two downward pointing petals whereas pansies have two upward pointing petals, giving them a "face."

One of the first to look out for from March to May is ***Viola odorata***, Sweet Violet, in woodland, hedgerows and scrub, often on base-rich soils. As its names suggests, it is sweet-scented, but contains the chemical ionine, which causes our sense of smell of the scent to be fleeting. I find them much more fragrant indoors than out. The flowers are violet, white or very rarely, pink. The hairs on the petioles of the all basal leaves are reflexed or appressed and leaves enlarge after flowering. This species has a distinctly creeping habit and can form very large patches where there is space. It is locally frequent in the Oswestry area and the south east of the county, but very rare in the in the agricultural lands of north east Shropshire.

Viola reichenbachiana, Early Dog-violet, will be flowering at about the same time, but is not fragrant. This one has leafy stems as well as a basal rosette. The flowers are bluish-mauve to violet with a darker spur; the top two petals usually stand upright, like Bugs Bunny. It is shade tolerant and found in woods and hedge-banks. It appears to prefer base-rich soils, but is not confined to them. The Oswestry uplands, Wenlock Edge, Clee Hills and the lower Severn Valley are good places to search carefully for this somewhat sparse species in the county.

The Common Dog-violet, ***Viola riviniana***, should flower later than the previous species, but they often overlap. The flowers are blue-violet with a much paler, very notched spur; the top two petals usually diverge, like Mickey Mouse ears, but not all plants have read the book. This is another one with leafy stems. It is a very tolerant species which grows in a wide variety of soils and habitats, including woods, grassland and hedge-banks. It grows abundantly throughout the county at all altitudes. The hybrid between this species and the previous one is uncommon in Shropshire, but may be under-recorded and may well increase as many plant species are starting to flower earlier.

Viola hirta, Hairy Violet, can be over-recorded in error for *Viola odorata*. Viola hirta grows in a nice neat tuft and does not have stolons so it does not creep and spread. The petioles have patent hairs and the flowers are not scented. Hairy Violet is a strong calcicole and intolerant of heavy grazing. It grows very sparsely in calcareous pastures and open scrub in the Oswestry uplands and Wenlock Edge. Searchers are much more likely to find the leaves, but it should flower April to May in the county.

The Heath-dog Violet, ***Viola canina***, has leafy stems and no basal rosette. The flowers are clear blue with a creamy yellow spur. The open areas in sandy soil of Prees Heath butterfly reserve are currently the only known location in the county where this lovely violet flourishes. Mid May is a good time to start looking for it.

Last, but not least, the Marsh Violet, ***Viola palustris***, has orbicular leaves, from cordate to reniform in outline, dull above and shiny below. The delicate flowers are bluish-lilac with darker veins. Flowers can be sparse amongst the numerous leaves, but May to July is the

time to look for them. It is often found on acid to neutral soils and occurs in a wide range of habitats, including bogs, fens, marshes, wet heaths and woods. It can be abundant where habitats survive, but agricultural drainage, ploughing and reseeding have severely reduced the number of sites in the county.

Violets were used in perfumes and herbal medicine and were reputed to have a psychosomatic healing effect, used for insomnia, headache and depression. John Gerard the herbalist was so impressed with their virtues that he recorded in writing that "their beauty and their grace, which is taken up hereby, cannot be but very good and honest; for they admonish and stir up a man to that which is comely and honest."

Species	**Flowers**	**Leaves**	**Habit**	**Habitat**
Viola canina	Clear blue with a creamy spur	No basal rosette. Leafy stems.	Creeping	Heaths and acid grasslands
Viola hirta	Blue-violet. Unscented	Hairs patent on petiole. Leaves deeply cordate & folded inwards	A neat tuft	Calcareous pastures and scrub
Viola odorata	Violet, white or v rarely pink. Scented.	Hairs reflexed or appressed on petiole	Creeping	Woodland, scrub and hedge-banks
Viola palustris	Bluish lilac with darker veins	Orbicular, cordate to reniform in outline	Creeping	Bogs, fens, marshes, wet heaths and woods
Viola reichenbachiana	Bluish-mauve with a darker spur	Leafy stems	Tufted	Woods and hedge-banks, often base-rich
Viola riviniana	Blue-violet with a paler v notched spur	Leafy stems	Tufted	Woods, grassland and hedge-banks

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The Spring 2001 Edition of the Shropshire Botanical Society Newsletter contains a pictorial key by Sarah Whild to violets and pansies in Shropshire. This edition can be downloaded as a pdf from the Society website: http://www.bsbi.org.uk/shropshire.html.

The Genus *Sphagnum* – a guide part 6: Microscopy

Martin Godfrey

Introduction

As an adjunct to this series of articles on the identification of *Sphagnum* I have been asked by a number of people if I could give some tips on microscopy, the better to be able to use the more advanced keys which are available. As I mentioned in my first article on the group, back in 2012, it is possible to identify most species with a lens in the field but this is conditional on the plants being well grown and typical. Plants in this genus can be morphologically very plastic making them, at times, difficult to identify and this is where the microscope comes in. There are many more identification features available at a microscopic level and these tend not to be variable meaning that you can usually get a reliable identification if you can use a microscope.

The purpose of this article is to describe and illustrate some of the more important microscopic features to help you identify your *Sphagnum.* For those of you unfamiliar with the microscope and the techniques I mention there will be a hands-on microscopy workshop at Preston Montford next autumn targeted specifically on *Sphagnum* – see page 6 for details.

Things to look for

We will look at features in three parts of the plant – the stem, the stem leaves and the branch leaves.

The stem

Here what we are interested in are the number of layers of cells in the stem cortex and, occasionally, pores in the outer cells of the cortex. (The cortex is the outer layer, or layers, of cells of the stem).

A thick stem cortex, visible with a lens, is a feature of section *Sphagnum* however the possession of one or more layers of cortex cells is also a diagnostic character for a number of species in the genus and to see these you will need a microscope. To see the stem cortex strip the capitulum and branches from your plant and cut thin sections of the stem with a fresh razor blade. Mount the resulting sections in a drop of water and examine under the medium power (×100) of the microscope (Fig 1). To see if there are any pores in the stem cortex cells and count and measure them if appropriate, strip a little of the cortex from the stem (previously stripped of capitulum and branches) and mount in a drop of water. You may need to use a higher power (×400) to see the pores properly (Fig 2).

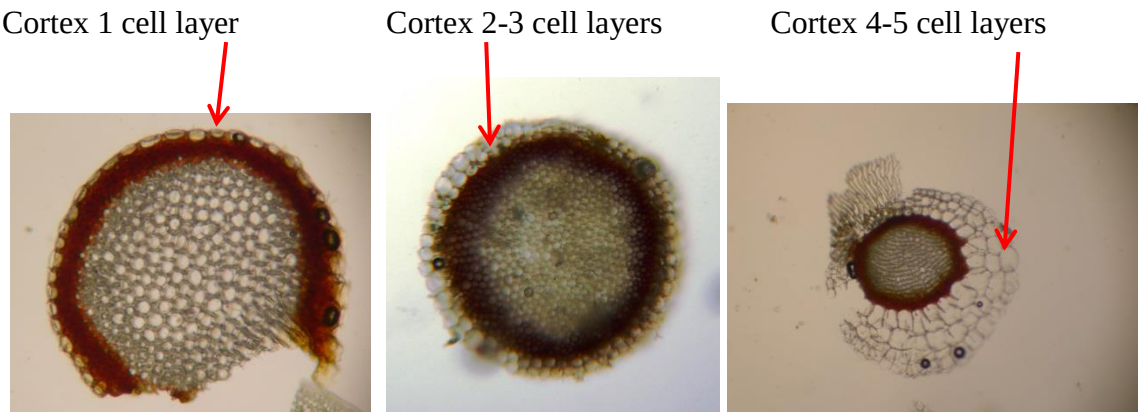

Fig 1. Stem cortex thickness.

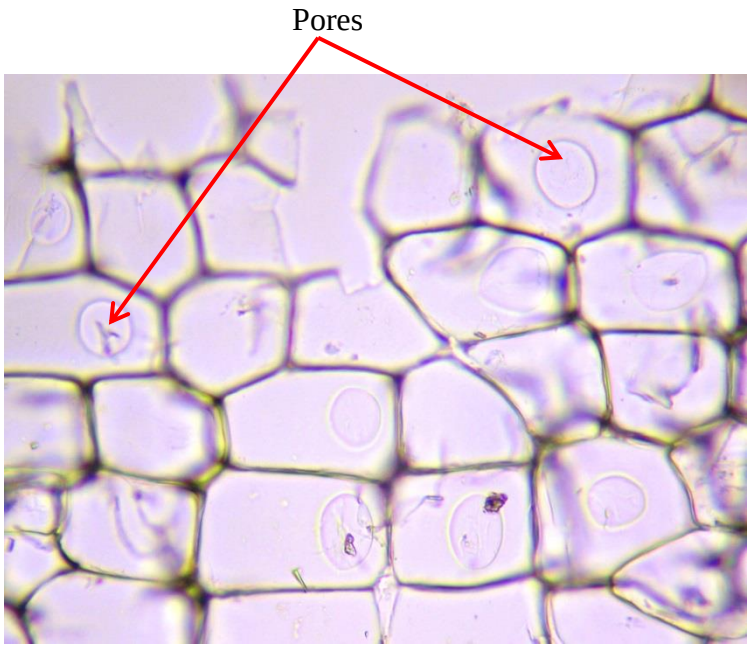

Fig 2. Stem cortex pores.

Stem leaves

Apart from the overall shape, which you can see with a lens, what we are interested in here are the presence, size and distribution of pores in the clear cells (hyalocysts) of the leaf , the presence and distribution of fibrils in the same cells and the presence and extent of thickened cells in the basal part of the leaf. To see these you will need to strip some stem leaves off the pre-prepared stem and mount them in a drop of water for examination – you will probably need to use all of the powers of your microscope in turn to see all of the features (Fig 3, 4 and 5).

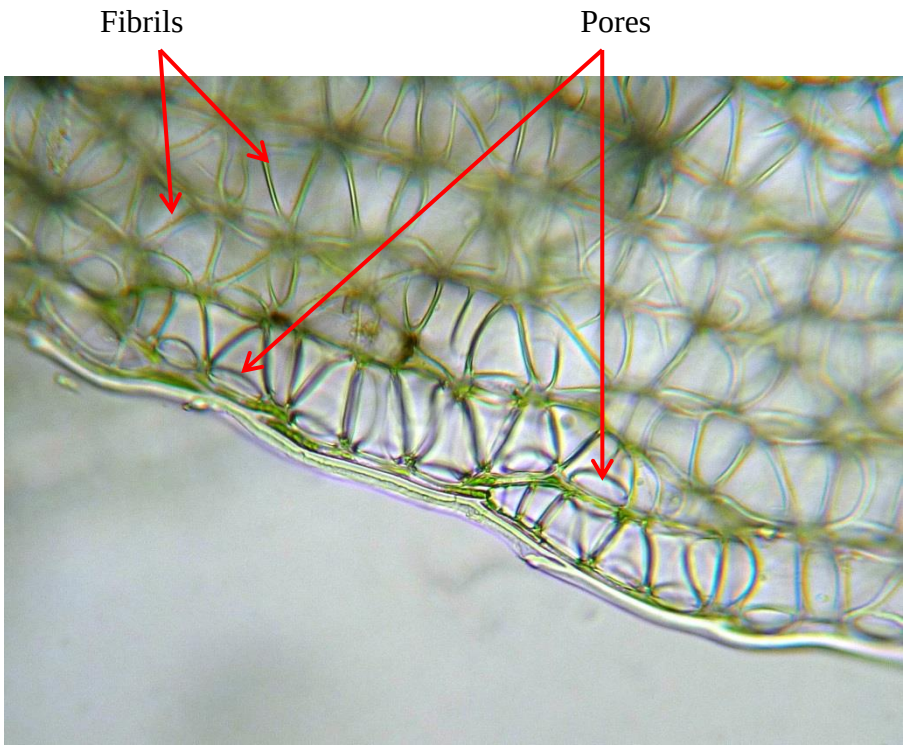

Fig 3. Pores and fibrils.

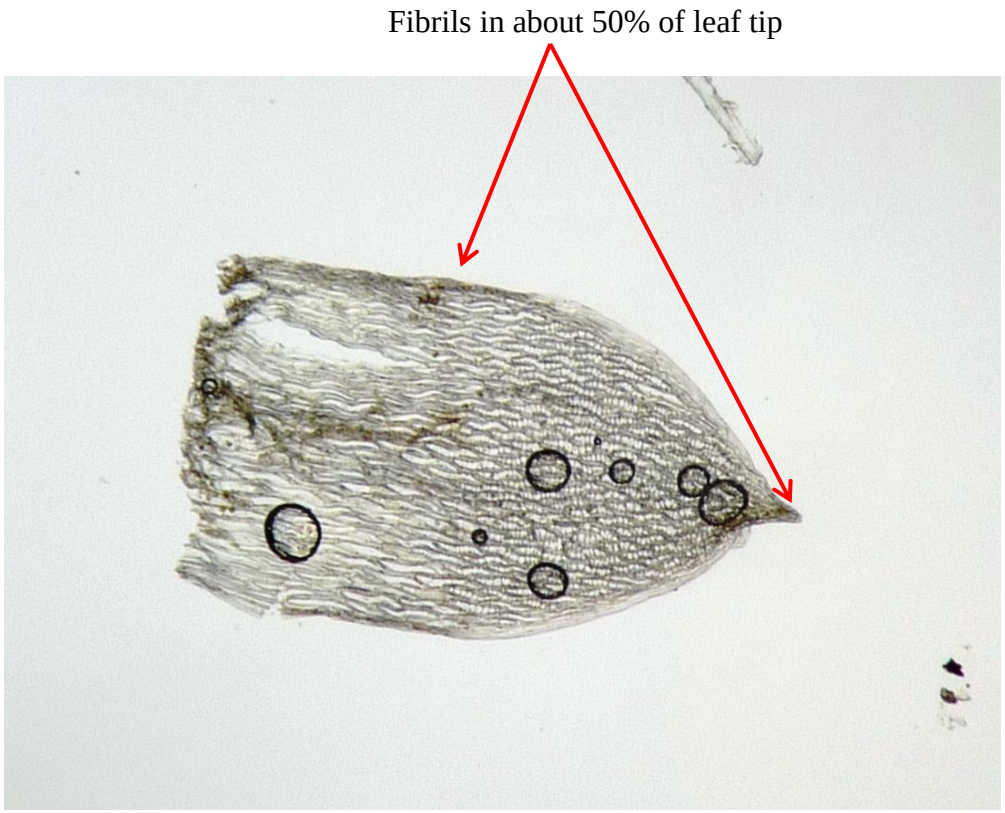

Fig 4. Extent of fibrils in leaf.

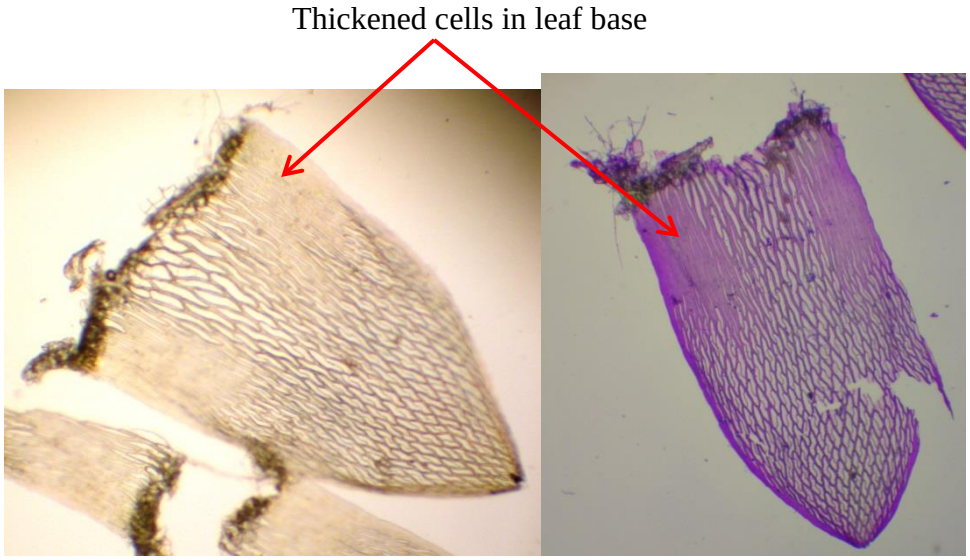

Fig 5. Thickened cells

Branch leaves

In the branch leaves what we are interested in are the presence and distribution of pores in the clear cells on both the concave and convex surface of the leaf. Occasionally we also need to look at whether the green cell (chlorocyst) of the leaf is more exposed on the convex or concave side of the leaf. To look for pores strip some leaves from branches and mount in a drop of water - some with their convex surface upwards and some with their concave surface upwards – and examine using the medium and high powers of your microscope (Fig 6).

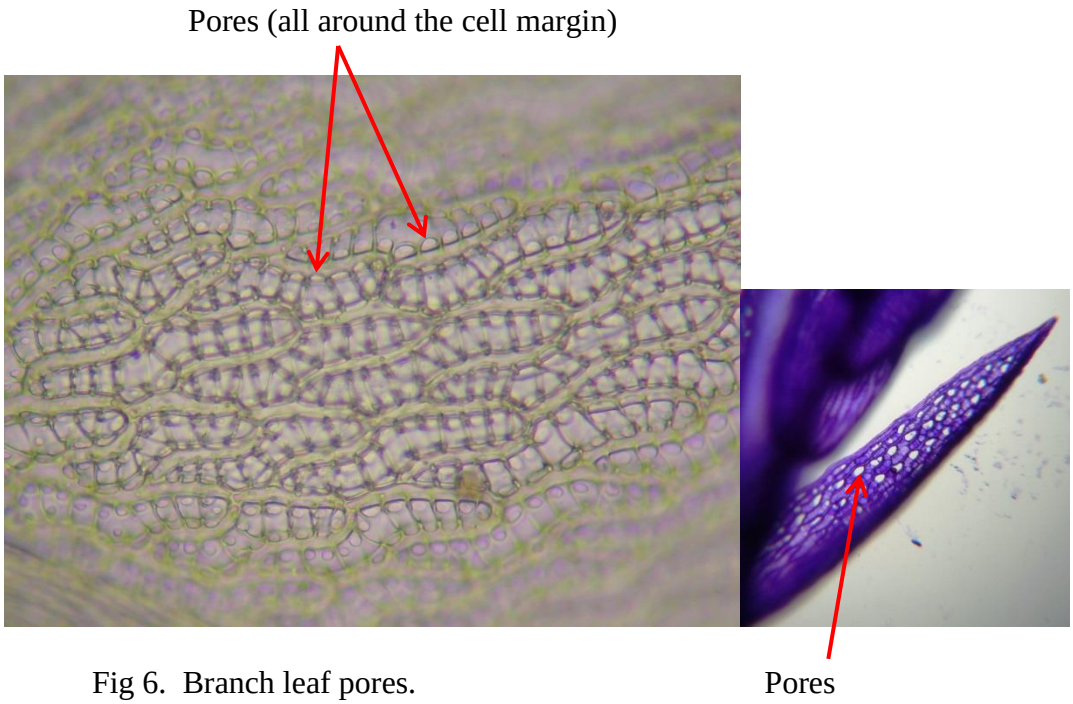

Fig 6. Branch leaf pores.

To look at the exposure of the chlorocysts you will need to cut sections of branch leaves using a fresh razor blade and mount them in water to examine under the medium and possibly the high power of your microscope. For clarity I have illustrated the options with a drawing – Fig 7 below.

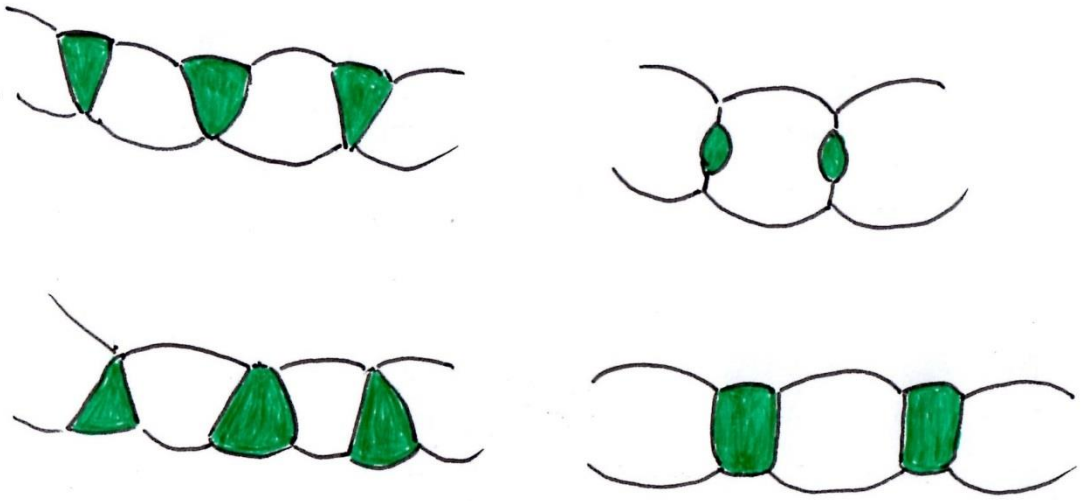

Fig 7. Exposure of Chlorocysts

Staining

Occasionally it is difficult to see the features you are looking for under the microscope, especially when you are examining leaves. If you have trouble you can stain the specimen with a solution of gentian violet in alcohol or water. Put the specimen into a drop of the stain and leave for a couple of minutes. Remove as much of the stain as you can with a bit of tissue and add a drop of water to the specimen before examining.

The Heathland Vegetation Communities of Catherton Common

Alex Lockton

The heathland at Catherton Common causes many difficulties for surveyors. I have surveyed it many times on my mires & heaths NVC courses, as it is a good site for demonstrating the need for computers to undertake vegetation analysis when the diagnosis is difficult.
On first inspection one can see a range of communities from dry grassland at the tops of slopes; through dry heath consisting of a mixture of heathers (*Calluna vulgaris* and *Erica cinerea*) and gorse (*Ulex gallii*); to Purple moor-grass (*Molinia caerulea*) grassland; and finally to wet heath with cross-leaved heath (*Erica tetralix*) and Bog Asphodel (*Narthecium ossifragum*) at the bottom.

Anyone looking at this succession and using the keys in British Plant Communities might easily assign each of these phases to a different NVC community: U4 *Festuca ovina-Agrostis capillaris* or U5 *Nardus stricta* for the grassland; H4 *Ulex gallii-Agrostis curtisii* for the dry heath; M25 *Molinia caerulea-Potentilla erecta* for the damp grassland; and M21 *Narthecium ossifragum-Sphagnum papillosum* for the wet heath. If they record quadrats in each of these areas and run them through a program like Match or Mavis, the original conclusion will be confirmed by the software and they will walk away convinced that they have the right answer.

A typical stand of heathland at Catherton Common.

There are some problems with this analysis, however. H4 *Ulex gallii* heath should not really occur in Shropshire. It is a very special form of coastal grass-heath that occurs in Cornwall,

Devon and South Wales, and it is characterised by the presence of the rare grass Bristle Bent (*Agrostis curtisii*), often with other rarities such as Cornish (*Erica vagans*) and Dorset Heaths (*E. ciliaris*). It is supposed to be a short grassland community with a mix of heathers and gorse no more than a few inches high, whereas Catherton Common is our more familiar dwarf shrub heath, with plants forming a layer 1 m high. Somehow H4 does not seem quite right for Shropshire. The reason it is keyed out as this is the combination of *Ulex gallii*, *Calluna vulgaris* and *Molinia caerulea* – but these are all common plants, and they could surely point to a range of other possible communities.

There are also problems with concluding that there is M25 *M. caerulea* grassland and M21 *N. ossifragum* mire: M25 is not an upland community, it is a tussocky, swampy grassland that occurs around lowland bogs on deep peat; M21 is a mire vegetation that should contain such things as White Beak-sedge (*Rhynchospora alba*) and Bog Myrtle (*Myrica gale*), which are not present.

The more you look at these communities, the less likely it seems that they could occur at Catherton Common. But if you use the keys and the software to identify them, the more convincingly these results turn up. A nagging doubt I always have is that a small number of rather common species is all that it takes to lead to these unlikely conclusions.

At this point it is a good idea to stop and ask why it is that we want to know the vegetation community of a site anyway. If all you desire is to colour it in on a habitat map and 'know' that you have a patch of this particular thing, then fine – accept the easy answer and leave it at that. But if NVC is to be useful it needs to do more than decorate maps. An NVC community might be the only place where a rare species of animal or plant occurs, so knowing exactly how much of each community you have, and how to manage it, could be key to ensuring its survival.

Admittedly, the NVC is not the final word on vegetation analysis. It was compiled in the 1970s and 1980s from a limited number of samples (about 30,000) and it describes most of the semi-natural communities that were recognised in Britain at that time. But things change. More samples can be recorded, the climate is changing, and new species are colonising and spreading. This means that in future it will be possible to create whole new vegetation classifications for Britain, and these may be completely different to the NVC in some ways, giving us a quite different understanding. But unfortunately what you cannot do is slowly morph the NVC into something different by stretching the definitions of the existing communities until they break. If H4 is to have any meaning, it has to remain 'that heathland which is restricted to the very SW of Britain and which contains Bristle Bent and various other characteristic associates.' It cannot be 'any damp heath that has Western Gorse and Heather' – that would be to give you a completely different meaning, and you could no longer assess the extent of the rare and valuable Cornish heathland type.

So how do we solve this problem? Well, there are no rules. You can say and do as you wish. Some people think that Catherton Common is an H4 heath with patches of M25 and M21, and I have seen elements of this written up in official reports. Others have started creating their own communities and describe 'humid heathlands with gorse and heathers' which encompass H4 and presumably several other types of heath. This is not necessarily wrong – perhaps the humid heathlands are due for revision in whatever replaces the NVC, and we will await that with interest.

The other approach is to stick with the NVC as it is, for better or for worse, and to see how the data we have fits best into the existing scheme of things. The first step is to subject the data to statistical analysis using Twinspan. This program clusters quadrats into groups based on the similarity of their species lists. Using heathlands from Catherton Common, other places in Shropshire, and Cornwall, I put the data through this program and got the clusters shown in Fig. 1.

Analysis of these clusters does not produce the expected results for Catherton Common at all. It does not even separate out the dry heath from the wet grassland and heaths – they all get lumped together into one. If you run that combined data through the computer it comes up with a new and very high correspondence with M15 *Scirpus cespitosus – Erica tetralix* wet heath. So what is that? It is not something that you get when you look at the different habitat patches individually.

M15 is a very diverse and species-rich community of humid moors and heaths throughout western Britain, from Devon to the Hebrides. It occurs at low- to mid-altitudes on the same soil types as at Catherton Common. It typically contains the three heathers that we get in Shropshire, Purple Moor-grass and Bog Asphodel. There should be some patches of Deergrass (*Trichophorum germanicum*, aka *Scirpus cespitosus*) but not necessarily in every sample. Some stands of M15 are very wet and rich in Sphagnum, while others are much drier and will hardly have any bog mosses at all.

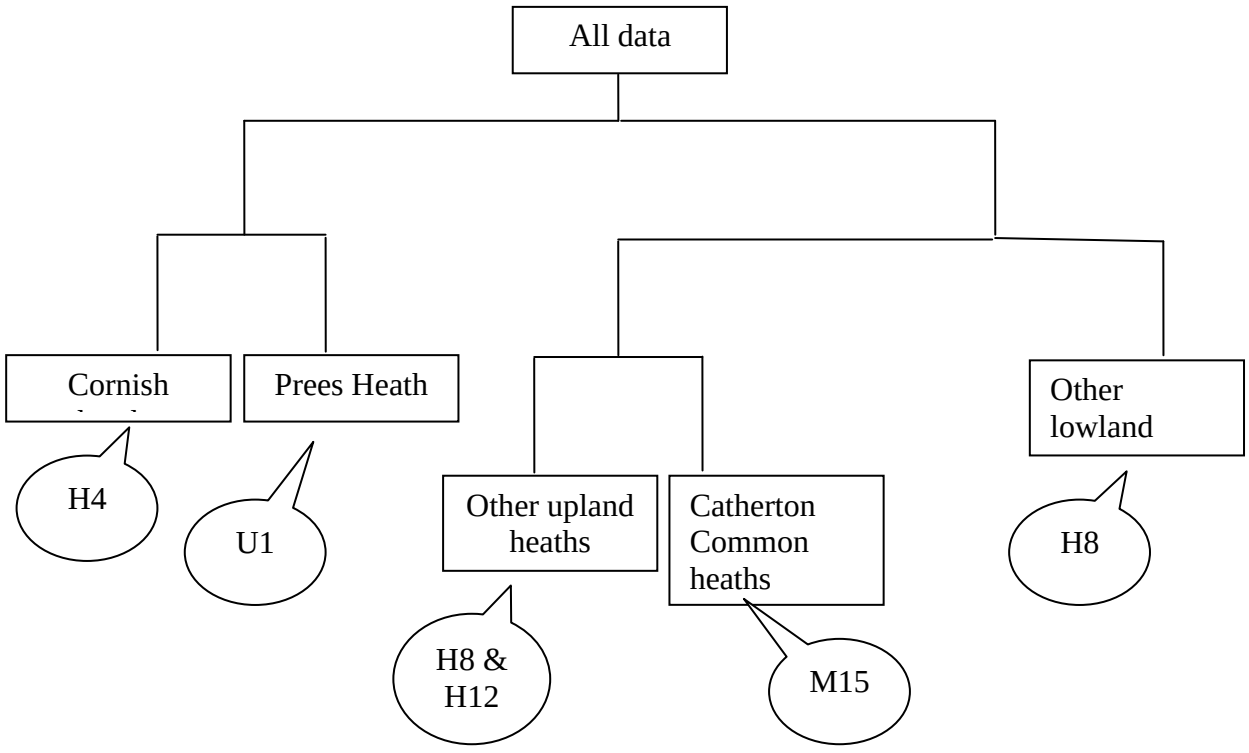

Figure 1. Twinspan analysis of heaths in Shropshire and Cornwall.

The only thing lacking in M15 that occurs at Catherton Common in abundance is gorse, *Ulex gallii*, which should not be in this community at all. But gorse is very common in Shropshire

and it can occur in a lot of different vegetation communities. It seems less of a stretch to imagine gorse spreading into a community that is normally a bit too wet for it than to imagine that we have a rare Cornish coastal grass-heath community occurring on a mountain in Shropshire.

So M15 seems to solve all the problems of the vegetation of Catherton Common. The suite of species that occurs in M15 includes everything that you can find in the putative H4, M21 and M25 communities that are so easy to pick out by eye. If you identify a distinctive community because of one or two very obvious species, it is easy to bias your quadrat recording towards those species and end up with the result you were expecting. Whereas a more random approach to sampling within a heterogeneous vegetation community would be less likely to go astray.

This is the best answer I can come up with to the mystery of Catherton Common. It has some practical benefits. For example, if we understand that the characteristic vegetation is M15, then we know this is a moist, westerly community on the eastern edge of its range. It is unlikely to thrive in a warmer, drier climate and the gorse will only help it to dry out. So controlling gorse might be key to conserving some of the rare species that are found there, including the marsh gentians (*Gentiana pneumonanthe*) at Cramer Gutter. Whereas if you believed it was a southerly community, you might allow the gorse to grow as it likes and trust climate change to continue to benefit the habitat. M15 is rare in Shropshire – this is the only known site for it – but it is quite possible that it still occurs on some of the hills in the Clun Forest and it might once have been in the Oswestry Hills as well. It is worth looking out for it, as it is clearly one of our more precious vegetation types.

With thanks to Ian Bennallick for supplying data on Cornwall and to all the students at Birmingham University and Manchester Metropolitan University for their studies of this site.

Natural England's Long Term Monitoring Network in Shropshire

Mark Duffell and John Handley

Natural England (NE), along with numerous partners, set up the Long Term Monitoring Network (LTMN) in 2010, based on the existing Environmental Change Network and Environmental Change Biodiversity Network. The purpose of the LTMN is to assess any potential effects on the natural environment and biodiversity that might be due to climate change, air pollution and changes in land management policy and practices. There are now 32 LTMN sites throughout England in a variety of habitats, including broadleaved woodland, heathland, neutral grassland, various bogs, mires and fens, sand dunes and salt marshes. All so far are within National Nature Reserves (NNRs), so in most cases NE is able to control or be informed of any management changes. Sampling of these sites is regularly undertaken, with recording of physical, chemical and biological variables all being measured in a standardised way, with the addition of Met Office weather station data at some sites.

It is hoped that the LTMN will pick up any early indications of the effects of Climate Change on the natural environment by observing changes in species composition, extension/retraction and loss/gain of species.

Each individual site has fifty permanent quadrats, marked with yellow Feno markers (square blocks approx 80 mm^3 embedded within the ground). The location of these permanent quadrats, whilst randomly arranged around the NNRs, was stratified to take in the main vegetation types present. The quadrats are 2 m by 2 m and are subdivided into twenty five 40 cm by 40 cm cells. A set of abiotic factors are recorded for the whole quadrat, including Altitude, Slope, Aspect, Land use and Broad habitat. Evidence of grazing and/or human disturbance was also recorded. For each cell the height of the vegetation was measured using a drop disk. Within each cell a list of species present (vascular plants, bryophytes and lichens) was recorded along with their percentage cover; also recorded was any litter or bare earth/rock.

Within Shropshire there are two LTMN sites: Fenn's, Whixall and Bettisfield Moss and the Stiperstones. *Arvensis Ecology* assessed the Stiperstones during late July 2014.
The first challenge was to find the permanent quadrats, always tricky whatever system is used to mark and relocate. We were using GPS with accuracies of between 2 and 8 m; unfortunately the installation of the markers had been done with a low accuracy GPS making our search areas quite large at times. Fortunately the installers had marked the quadrats with a short wooden stake, which in low heathland/grassland was often visible from many metres away. Only occasionally was it missing, when it had either been smashed by heather mowing machinery or burnt during an uncontrolled burn of the heathland. Equally, where the Gorse, Bracken or Heathland had grown up (it was 4 years since the stakes were installed and the sites surveyed), it was often hard to relocate the quadrats. Locating the quadrats could be especially challenging given the terrain (up to 42 degrees in one case) and dense vegetation.

Of the 50 quadrats, 40 were located in Upland Heathland, 5 in Purple-moor grass and rush pastures, 4 in lowland dry acid grassland pasture and 1 in improved grassland. A total of 71 vascular plants, 32 bryophytes and 8 lichens were recorded to species and/or subspecies level. Species richness within the quadrats varied from just 4 species (Bracken dominated

heathland) up to 28 species (a wet flush in Purple moor-grass and rush pasture). *Deschampsia flexuosa* Wavy Hair-grass and *Vaccinium myrtillus* Bilberry were the most common species found in 43 quadrats. *Calluna vulgaris* Heather a species synonymous with the Stiperstones was recorded in 36 quadrats. Since the previous survey was undertaken *Melampyrum pratense* ssp. *pratense* seems to have become more common although this could be due to different management or a variation in the recorders. The previous survey found 66 vascular plants, 33 bryophytes and 10 lichens; those species not re-recorded during this survey include *Blechnum spicant* Hard Fern, *Lolium multiflorum* Italian Rye-grass, *Oxalis acetosella* Wood Sorrel, *Pedicularis sylvatica* Lousewort and *Urtica dioica* Nettle. New species only recorded this year include *Agrostis vinealis* Brown Bent, *Aira praecox* Early Hair-grass, *Cerastium fontanum* Common Mouse-ear, *Chamerion angustifolium* Rosebay Willowherb, *Juncus conglomeratus* Compact Rush, *Lolium perenne* Perennial Rye-grass, *Luzula multiflora* ssp. *congesta* Heath Wood-rush, *Poa trivialis* Rough Meadow-grass , *Taraxacum* agg. a Dandelion. Sadly, *Phytophthora* was also found within or near to several quadrats.

The data were analysed and a condensed output from the TWINSPAN analysis "two way indicator species analysis" (Hill,1979) was used to draw a dendrogram representing a division of the quadrats. MAVIS (2000) was used to match divisions attributed through the TWINSPAN analysis with particular National Vegetation Classification plant communities. These were then assessed against the descriptions in Rodwell (1991 *et seq.*). Using this method, 46 of the 50 quadrats were attributed to five different communities (Table 1 and Table 2). One quadrat was severely burnt, which would influence that classification, and another was overgrown with *Ulex europaeus* Gorse. We have not been able to attribute a community to some of the quadrats.

	National Vegetation Classification community	No of Quadrats
Group 1	H12a *Calluna vulgaris-Vaccinium myrtillus* heath, *Calluna vulgaris* sub-community	34
Group 2	M6a *Carex echinata-Sphagnum recurvum/auriculatum* mire, *Carex echinata* sub-community	2
Group 3	U4 *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland	4
Group 4	M23b *Juncus effusus/acutiflorus-Galium palustre* rush-pasture *Juncus effusus* sub-community	2
Group 5	U20c *Pteridium aquilinum-Galium saxatile* community, species-poor sub-community	4
	Unclassified	4
	Total	50

Table 1: National Vegetation communities identified from quadrat data.

Group 1

NVC	Percentage
H12a	**66.18**
H12	60.50
H12b	58.20
H12c	57.17
W18	51.25
W17d	50362.00
U20b	49.81
W18c	48.19
W18b	47.56
H18	46.61

Group 2

NVC	Percentage
M6b	53.28
M6a	**51.71**
M6	50.39
M15a	48.66
M6d	47.62
M25a	45.7
M25	44.58
M21b	42.73
M15	42.33
M24c	42.1

Group 3

NVC	Percentage
U4a	68.85
U4	**64.95**
U20a	63.28
U20	61.24
U4b	59.28
W23a	57.1
CG10a	57.04
U4e	56.34
U4d	56.17
SD12a	55.18

Group 4

NVC	Percentage
W4b	44.78
U2b	43.98
M23b	**43.85**
U5b	42.37
W4	41.64
M6d	41.41
M6	41.41
U16	41.39
U5a	41
U5d	40.52

Group 5

NVC	Percentage
W16a	49.81
W16	48.43
U20c	**47.55**
H8e	45.31
H12a	44.49
U20b	42.51
U2	41.24
U16c	40.17
U20	40.08
H2b	38.37

Table 2: Mavis summaries for Groups 1-5; attributed communities highlighted in bold.

Analysis of individual quadrats

One quadrat (31) was located on a steep south-westerly-facing slope; previous surveys had shown it to be mainly dominated by *Ulex gallii* Western Gorse, with a small area of *U. europaeus* in the lowest parts. We found that the whole quadrat was now dominated by *U. europaeus* so high it nearly dwarfed the surveyors (see photo back cover). It appears that the *U. gallii* community was being driven higher up the slopes, closely followed by *U. europaeus.* Further investigation may be able to distinguish whether this is a general trend and these communities are now thriving at higher altitudes. There may be many causes for this including nitrogen deposition or climate change. The aims of the LTMN will be to try and understand these changes.

The *Calluna vulgaris*-*Vaccinium myrtillus* heath, *Calluna vulgaris* sub-community was, as anticipated, the dominant community. Typically either *C. vulgaris* or *V. myrtillus* share this community, occupying three-quarters to a hundred per cent of the cover between them, depending on the stage of degeneration of the *C. vulgaris.* These two sub-shrubs dominated the vegetation, only allowing *P. aquilinum* to appear in small quantities; up to a fifth of the quadrat. *D. flexuosa* was constant at very low volumes, two or three per cent, often drawn and leggy within what could be extremely high quantities of litter; up to eighty five per cent

in mature stands of *Calluna*. Degenerate stands were more open, enabling pleurocarpous mosses such as *Hypnum jutlandicum*, *Pleurozium schreberi* and *Pseudoscleropodium purum* to become established.

The *Carex echinata-Sphagnum recurvum/auriculatum* mire, *Carex echinata* sub-community is a poor-fen in which either small sedges such as *Carex echinata*, *C. nigra*, *C. panicea* and *C. demissa* or rushes such as *Juncus acutiflorus*, *J. bulbosus* and *J. conglomeratus* dominate over a carpet of bryophytes dominated by Sphagna.

Discussion

The hardest part of the LTMN survey work was relocating the quadrats. In some cases it was possible to locate them from a hundred metres away by relying on the wooden stakes. However, even with a stake, relocating markers in dense bracken was virtually impossible without adversely affecting the vegetation that was being surveyed.

Where the terrain and slope of the site is not prohibitive the heathland is being managed. Historically this would have been done through controlled burning, but this is now done through mowing and removing the arisings, presumably by baling. This is to try and provide a mosaic of *Calluna* at different points in its lifecycle. This management does not appear to account for the locations of the permanent quadrats and, as a consequence, some quadrats will periodically be mown whereas the majority will not. It is not practicable, or desirable, to prevent this type of management, but analysis must take into consideration the effect management practices have on the vegetation, e.g. was the increased occurrence of *Melampyrum pratense* ssp. *pratense* on plots down to recent management or the ability of different surveyors? Determining the factors that precipitate change within communities is complex, and ensuring that management practices are consistent means that the data will be more robust.

Can this project be defined as monitoring?

"Monitoring is an ongoing programme of repeatable survey work which is capable of detecting change and that change which exceeds certain predefined limits will then trigger action" (Goldsmith 1991).

At its best the LTMN has the capacity to detect changes and may, if interpreted effectively, determine what the drivers of those changes are. Being able to advise others on mitigation or adaptation and adapt existing interventions based on the outcomes of the LTMN means that it has the potential to be an effective monitoring tool *as long as* the data has the capacity to standardise site management and data collection.

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Web-based botanical resources - Maps

John Handley

This is the first in a sequence of articles in which I intend to discuss a variety of resources that can be found online. This first article will focus on map resources.

Where's the path 3
An incredibly useful site that I use almost daily. There is a limit to the amount of Ordnance Survey data that can be used and when this is up you'll receive images of historic maps so it's best to use this site early in the day. It provides free Ordnance Survey mapping displayed side by side with a variety of alternative screens including Google Aerial Imagery, historic maps and geological information. The two screens can be linked together or operated separately. Grid references can be imported or exported as GPX data. Route lengths can be calculated as well as areas. Terrains can be graphed to display altitudes between points. Grid references can be displayed in a variety of formats: standard 6, 8 or 10 figure grid references, dinty and Watsonian vice county. This site is also mobile friendly. Available here:
http://wtp2.appspot.com/wheresthepath.htm

A useful guide to the coordinate systems in Great Britain is available at:
http://www.bnhs.co.uk/focuson/grabagridref/html/OSGB.pdf

Bedfordshire Natural History Society
This Natural History Society operates the Grab a Grid Reference website. This also has a split screen set up that enables you to make different vice county borders visible. The screen on the left is a Google satellite image whilst the screen on the right is an Ordnance Survey OpenSpace map.

The right map tracks the left map whenever it is zoomed, panned or the marker moves, but the right map can be zoomed and panned on its own. There is a search facility that operates using grid references, postcodes and place names. The mapping facility is becoming more available elsewhere and Keith Balmer, the webmaster of the BNHS website provides information on setting this up on other not-for-profit websites. There is a mobile version although I don't tend to find it as easy to use. Available here:
http://www.bnhs.co.uk/focuson/grabagridref/html/index.htm

Grid reference finder
Is a map that can be searched using postcodes, addresses, grid references or the World Geodetic System (WGS). Several points can be plotted on the map at the same time. It also, very usefully, enables one to import large numbers of points as batches. These can be exported as a KML file which can then be opened in Google Earth.
http://www.gridreferencefinder.com/

Google Earth
http://www.google.co.uk/intl/en_uk/earth/explore/products/plugin.html
This software works well if downloaded, though it can also be used over the web and there is also a mobile friendly version. Google Earth provides a comprehensive world map that is searchable through postcode, address or WGS. GIS applications can be done on Google Earth, which means different layers can be added to a map so that one can produce personalised maps and save these files. An online conversion tool for KML, shapefiles, and

MapInfo files, is available at http://geoconverter.hsr.ch. I use this to display all the vice county boundaries and because it is zoomable to high degree and can be used to obtain a high degree of accuracy before I go into the field (further details within the Bedfordshire Natural History Society website at http://www.bnhs.co.uk/focuson/google/html/index.htm and the file is within the National Biodiversity Network website: http://www.nbn.org.uk/Tools-Resources/Recording-Resources/Mapping/Recording-software.aspx as a free download.

The 3D views with aerial photos are a great tool but it's best to increase the 'Elevation exaggeration' to 2 or even 3 times. Using the 'Tools' menu, then 'Options' and then adjusting the 'Elevation exaggeration'. This intensifies the contours enabling you to pick out hollows that previously might have escaped your attention.

There is a history facility built in too – you can look at aerial photos from a selection of different years by clicking the clock with the backwards green arrow in the toolbar at the top to 'Show historical imagery'. There are even some aerial images around the edges of Shropshire from 1945.

Cranfield Soil and Agrifood Institute
Provide Soilscapes under the auspices of Cranfield University: http://www.landis.org.uk/soilscapes/#. This website provides details of soil types, texture, drainage and fertility.

Old Maps
Operates a straight-forward commercial site providing a variety of different types of historical maps at: https://www.old-maps.co.uk/#/.

MAGIC
Magic is an interactive website managed by Natural England that provides geographic information about the natural environment from across government. Different areas can be displayed upon a base map at controllable levels of transparency. The map can display several layers at the same time, including site designations, habitat types, land based schemes i.e. agri-environment schemes, geology and soils as well as OS mapping up to 1:2,500. Particularly useful if you wish to become more familiar with an area you intend to visit. http://www.magic.gov.uk/.

Google Maps
Often a default place to start when looking at somewhere, this facility enables you to record specific locations and obtain directions and approximate times for journeys. This extends into street viewer, by dragging and dropping the little figure of a person in the bottom corner, one is able to simulate driving actual routes. Images that have been uploaded including video's and panoramic images are available courtesy of the ^ character.

Online road verge reporting form
Shropshire Council is recording species-rich road verges and the details will hopefully reduce unnecessary cutting of flowering plants. Make sure your favourite verge is listed! Fill in the form here: http://shropshire.gov.uk/maps/Sites/RoadVergesSurvey/

Shropshire Council site-based reports
An ever-growing body of geographically specific 'grey literature' is being made available on the Shropshire Council web pages. This includes the SEDN one page reports and also

Shropshire Botanical Society newsletter articles. Do let Shropshire Council have other items that could be made available this way. The trial map is available here:
http://shropshire.gov.uk/maps/biodiversity/index.html

Shropshire Council Natural Environment layers
Various layers of information are available from the Shropshire Council web map system including the progress of the Phase 1 mapping groups – mostly based in north Shropshire:
http://shropshire.gov.uk/maps/natenvironment.htm
Shropshire Council hope to add more data to these maps in due course.

Bing Maps
For most parts of Shropshire, Bing maps are more up to date than Google Maps. Also for the Shropshire and Telford areas try selecting 'Birds eye view'. When zoomed in the town you can rotate the direction of view of the oblique aerial photo by using the curved arrows either side of the north arrow. It's a great way to see around objects. Bing Maps also has a version of Google StreetView but the coverage barely makes it into Shropshire.
http://www.bing.com/maps

Other mapping resource
A huge range of mapping resources are also listed here:
https://sites.google.com/site/kitenetter/Home/bio-recording/mapping

Thanks to Mark Duffell and Dan Wrench for their input and suggestions. We are interested to hear of any other web sites or technological innovations that make your botanical recording easier or more interesting.

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Membership is **£15 a year or £30 for three years, renewable on Jan 1st of the year shown**. Please send cheques made out to *Shropshire Botanical Society*, to Mark Duffell 19 Compton Mews, Ford, Shrewsbury, SY5 9NX. If your name is in bold your renewal is due and this will be your last newsletter.

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Ulex europaeus, Gorse in Quadrat 31, Stiperstones NNR, Long Term Change Monitoring Programme, photo M. Duffell, 2014.